

SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XVI. No. 405.

NEW YORK, NOVEMBER 7, 1890.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

ANTARCTIC EXPLORATION.¹

My experience during the four years which have elapsed since this project was first mooted in Melbourne, is that any reference to the subject is sure to be met with the query *Cui bono?* What good can it do? What benefit can come from it? What is the object to be served by such an expedition?

In setting myself to the task of answering these questions, let me observe that it would indeed be strange if an unexplored region eight million square miles in area,—twice the size of Europe,—and grouped around the axis of rotation and the magnetic pole, could fail to yield to investigators some novel and valuable information. But when we notice that the circle is engirdled without by peculiar physical conditions which must be correlated to special physical conditions within, speculation is exchanged for a confident belief that an adequate reward must await the skilled explorer. The expected additions to the geography of the region are, of all the knowledge that is to be sought for there, the least valuable. Where so many of the physical features of the country—the hills, the valleys, and the drainage lines—have been buried beneath the snow of ages, a naked outline, a bare skeleton of a map, is the utmost that can be delineated. Still, even such knowledge as this has a distinct value, and, as it can be acquired by the explorers as they proceed about their more important researches, its relatively small value ought not to be admitted as a complete objection to any enterprise which has other objects of importance. Our present acquaintance with the geography of the region is excessively limited. Ross just viewed the coast of Victoria Land, between 163° east and 160° west longitude. He trod its barren strand twice, but on each occasion for a few minutes only. From the adjacent gulf he measured the heights of its volcanoes, and from its offing he sketched the walls of its icy barrier. Wilkes traced on our map a shore-line from 97° to 167° east longitude, and he backed it up with a range of mountains, but he landed nowhere. Subsequently Ross sailed over the site assigned to part of this land, and hove his lead 600 fathoms deep where Wilkes had drawn a mountain. He tells us that the weather was so very clear, that, had high land been within 70 miles of that position, he must have seen it (*Ross's Voyage*, 1278). More recently Nares, in the "Challenger," tested another part of Wilkes's coast-line, and with a like result; and these circumstances throw doubts upon the value of his reported discoveries. D'Urville subsequently followed a bold shore for a distance of about 300 miles from 136° to 142° east longitude, while in

67° south latitude, and between 45° and 60° east longitude are Enderby's and Kemp's lands. Again, there is land to the south of the Horn, which trends from 45° to 75° south latitude. These few discontinuous coast lines comprise all our scanty knowledge of the Antarctic land. It will be seen from these facts that the principal geographical problem awaiting solution is the interconnection of these scattered shores. The question is, do they constitute parts of a continent, or are they, like the coasts of Greenland, portions of an archipelago, smothered under an overload of frozen snow, which conceals their insularity? Ross inclined to the latter view, and he believed that a wide channel leading towards the pole existed between North Cape and the Balleny Islands (*Ross's Voyage*, 1221). This view was also held by the late Sir Wyville Thompson. A series of careful observations upon the local currents might throw some light upon these questions. Ross notes several such in his log. Off Possession Island a current, running southward, took the ships to windward (*Ross's Voyage*, 1195). Off Coulman Island another drifted them in the same direction at the rate of 18 miles a day (*Ross's Voyage*, 1204). A three-quarter knot northerly current was felt off the Barrier, and may have issued from beneath some part of it. Such isolated observations are of little value, but they were multiplied; and were the currents correlated with the winds experienced, the information thus obtained might enable us to detect the existence of straits, even where the channels themselves are masked by ice-barriers.

Finally it is calculated that the centre of the polar ice-cap must be three miles, and may be twelve miles, deep, and that, the material of this ice mountain being viscous, its base must spread out under the crushing pressure of the weight of its centre. The extrusive movement thus set up is supposed to thrust the ice cliffs off the land at the rate of a quarter of a mile per annum. These are some of the geographical questions which await settlement.

In the geology of this region we have another subject replete with interest. The lofty volcanoes of Victoria Land must present peculiar features. Nowhere else do fire and frost divide the sway so completely. Ross saw Erebus belching out lava and ashes over the snow and ice which coated its flanks. This circumstance leads us to speculate on the strata that would result from the alternate fall of snow and ashes during long periods and under a low temperature. Volcanoes are built up, as contradistinguished from other mountains, which result from elevation or erosion. They consist of *débris* piled round a vent. Lava and ashes surround the crater in alternate layers. But in

¹ Address delivered at the annual meeting of the Bankers' Institute of Australasia, Aug. 27, 1890, by G. S. Griffiths.

this polar region the snowfall must be taken into account as well as the ash deposit and the lava-flow. It may be thought that any volcanic ejecta would speedily melt the snow upon which they fell, but this does not by any means necessarily follow. Volcanic ash, the most widespread and most abundant material ejected, falls comparatively cold, cakes, and then forms one of the most effective non-conductors known. When such a layer, a few inches thick, is spread over snow, even molten lava may flow over it without melting the snow beneath. This may seem to be incredible, but it has been observed to occur. In 1828, Lyell saw on the flanks of Etna a glacier sealed up under a crust of lava. Now, the Antarctic is the region of thick-ribbed ice. All exposed surfaces are quickly covered with snow. Snow-falls, ash-falls, and lava-flows must have been heaping themselves up around the craters during unknown ages. What has been the result? Has the viscosity of the ice been modified by the intercalation of beds of rigid lava and of hard-set ash? Does the growing mass tend to pile up, or to settle down and spread out? Is the ice wasted by evaporation, or does the ash-layer preserve it against this mode of dissipation? These interesting questions can be studied round the south pole, and perhaps nowhere else so well.

Another question of interest, as bearing upon the location of the great Antarctic continent, which it is now certain existed in the secondary period of geologists, is the nature of the rocks upon which the lowest of these lava-beds rest. If they can be discovered, and if they then be found to be sedimentary rocks such as slates and sandstones, or Plutonic rocks such as granite, they will at once afford us some data to go upon, for the surface exposure of granite signifies that the locality has been part of a continental land sufficiently long for the weathering and removal of the many thousands of feet of sedimentary rocks which of necessity overlie crystalline rocks during their genesis; while the presence of sedimentary rocks implies the some-time proximity of a continent, from the surfaces of which alone these sediments, as rainwash, could have been derived.

As ancient slate rocks have already been discovered in the ice-clad South Georgias, and as the drag-nets of the "Erebus" and the "Challenger" have brought up from the beds of these icy seas fragments of sandstones, slates, and granite, as well as the typical blue mud which invariably fringes continental land; there is every reason to expect that such strata will be found.

Wherever the state of the snow will permit, the polar mountains should be searched for basaltic dikes, in the hope that masses of specular iron and nickel might be found similar to those discovered by Nordenskiöld at Ovifak, in North Greenland. The interest taken in these metallic masses arises from the fact that they alone, of all the rocks of the earth, resemble those masses of extra-terrestrial origin which we know as meteorites. Such bodies of unoxidized metal are unknown elsewhere in the mass, and why they are peculiar to the Arctic it is hard to say. Should similar masses be found within the Antarctic, a fresh stimulus would be given to speculation. Geologists would have to consider whether the oxidized strata of the earth's crust thin out at the poles; whether in such a case the thinning is due to severe local erosion, or to the protection against oxygen afforded to the surface of the polar regions by their ice-caps;

or to what other cause. Such discoveries would add something to our knowledge of the materials of the interior of our globe and their relation to those of meteorites.

Still looking for fresh knowledge in the same direction, a series of pendulum observations should be taken at points as near as possible to the pole. Within the Arctic Circle the pendulum makes about 240 more vibrations per day than it does at the equator. The vibrations increase in number there, because the force of gravity at the earth's surface is more intense in that area; and this, again, is believed to be due to the oblateness of that part of the earth's figure, but it might be caused by the bodily approach to the surface at the poles of the masses of dense ultra-basic rocks just referred to. Thus, pendulum experiments may reveal to us the earth's figure; and a series of such observations recorded, from such a vast and untried area, must yield important data for the physicist to work up. We should probably learn from such investigations whether the earth's figure is as much flattened at the Antarctic as it is known to be at the Arctic.

We now know that in the past the north-polar regions have enjoyed a temperate climate more than once. Abundant seams of paleozoic coal, large deposits of fossiliferous jurassic rocks, and extensive eocene beds, containing the remains of evergreen and deciduous trees and flowering plants, occur far within the Arctic Circle. This circumstance leads us to wonder whether the corresponding southern latitudes have ever experienced similar climatic vicissitudes. Conclusive evidence on this point it is difficult to get; but competent biologists who have examined the floras and faunas of South Africa and Australia, of New Zealand, South America, and the isolated islets of the Southern Ocean, find features which absolutely involve the existence of an extensive Antarctic land,—a land which must have been clothed with a varied vegetation, and have been alive with beasts, birds, and insects. As it also had had its fresh-water fishes, it must have had its rivers flowing and not frost-bound, and in those circumstances we again see indications of a modified Antarctic climate. Let us briefly consider some of the evidence for the existence of this continent. We are told by Professor Hutton of Christchurch that 44 per cent of the New Zealand flora is of Antarctic origin. The Auckland, Campbell, and Macquarie Islands all support Antarctic plants, some of which appear never to have reached New Zealand. New Zealand and South America have three flowering plants in common, also two fresh-water fishes, five seaweeds, three marine crustaceans, one marine mollusk, and one marine fish. Similarly New Zealand and Africa have certain common forms; and the floras and faunas of the Kerguelen, the Crozets, and the Marion Islands are almost identical, although in each case the islands are very small and very isolated from each other and from the rest of the world. Tristan d'Acunha has 58 species of marine *Mollusca*, of which number 13 are also found in South America, six or seven in New Zealand, and four in South Africa (Hutton's *Origin of New Zealand Flora and Fauna*). Temperate South America has 74 genera of plants in common with New Zealand, and 11 of its species are identical (Wallace's *Island Life*). Penguins of the genus *Eudyptes* are common to South America and Australia (Wallace's *Dist. of Animals*, 1399). Three groups of fresh-water fishes are entirely con-

fined to these two regions. *Aphritis*, a fresh-water genus, has one species in Tasmania, and two in Patagonia. Another small group of fishes known as the *Haploichitonidæ* inhabit Tierra del Fuego, the Falklands, and South Australia, and are not found elsewhere; while the genus *Galaxias* is confined to south temperate America, New Zealand, and Australia. Yet the lands which have these plants and animals in common are so widely separated from each other that they could not now possibly interchange their inhabitants. Certainly towards the equator they approach each other rather more; but even this fact fails to account for the present distribution, for, as Wallace has pointed out, "the heat-loving *Reptilia* afford hardly any indications of close affinity between the two regions" of South America and Australia, "while the cold-enduring *Amphibia* and fresh-water fishes offer them in abundance" (Wallace, *Dist. of Animals*, 1400). Thus we see that to the north interchange is prohibited by tropical heat, while it is barred to the south by a nearly shoreless circumpolar sea. Yet there must have been some means of intercommunication in the past, and it appears certain that it took the shape of a common fatherland for the various common forms from which they spread to the northern hemisphere. As this fatherland must have been accessible from all these scattered southern lands, its size and its disposition must have been such as would serve the emigrants either as a bridge or as a series of stepping-stones. It must have been either a continent or an archipelago.

But a further and a peculiar interest attaches to this lost continent. Those who have any acquaintance with geology know that the placental *Mammalia*—that is, animals which are classed with such higher forms of life as apes, cats, dogs, bears, horses, and oxen—appear very abruptly with the incoming of the tertiary period. Now, judging by analogy, it is not likely that these creatures can have been developed out of mesozoic forms with any thing like the suddenness of their apparent entrance upon the scene. For such changes they must have acquired a long time, and an extensive region of the earth; and it is probable that each of them had a lengthy series of progenitors, which ultimately linked it back to lower forms.

Why, then, it is constantly asked, if this was the sequence of creation, do these missing links never turn up? In reply to this query, it was suggested by Huxley that they may have been developed in some lost continent, the boundaries of which were gradually shifted by the slow elevation of the sea-margin on one side and its simultaneous slow depression upon the other; so that there has always been in existence a large dry area with its live-stock. This dry spot, with its fauna and flora, like a great raft or Noah's Ark, moved with great slowness in whatever direction the great earth undulation travelled. But to-day this area, with its fossil evidences, is a sea-bottom; and Huxley supposes that the continent, which once occupied a part of the Pacific Ocean, is now represented by Asia.

This movement of land-surface translation eastwards eventually created a connection between this land and Africa and Europe; and if, when this happened, the *Mammalia* spread rapidly over these countries, this circumstance would account for the abruptness of their appearance there.

Now, Mr. Blandford, the president of the Geological Society of London, in his annual address recently delivered,

advances matters a stage further; for he tells us that a growing acquaintance with the biology of the world leads naturalists to a belief that the placental *Mammalia*, and other of the higher forms of terrestrial life, originated during the mesozoic period—still further to the southwards, that is to say—in the lost Antarctic continent, for the traces of which we desire to seek.

But it almost necessarily follows, that, wherever the *Mammalia* were developed, there also man had his birthplace; and, if these speculations should prove to have been well founded, we may have to shift the location of the Garden of Eden from the northern to the southern hemisphere.

I need hardly suggest to you that possibilities such as these must add greatly to our interest in the recovery of any traces of this mysterious region. This land appears to have sunk beneath the seas after the close of the mesozoic. Now, the submergence of any mass of land will disturb the climatic equilibrium of that region, and the disappearance of an Antarctic continent would prove extremely potential in varying the climate of this hemisphere; for to-day the sun's rays fall on the south-polar regions to small purpose. The unstable sea absorbs the heat, and in wide and comparatively warm streams it carries off the caloric to the northern hemisphere, to raise its temperature at the expense of ours. But when extensive land received those same heat-rays, its rigid surfaces, so to speak, tethered their caloric in this hemisphere; and thus, when there was no mobile current to steal northwards with it, warmth could accumulate, and modify the climate.

Under the influences of such changes, the icy mantle would be slowly rolled back towards the south pole, and thus many plants and animals were able to live and multiply in latitudes that to-day are barren. What has undoubtedly occurred in the extreme north is equally possible in the extreme south. But if it did occur,—if south-polar lands, now ice-bound, were then as prolific of life as Disco and Spitzbergen once were,—then, like Spitzbergen and Disco, the unsubmerged remnants of this continent may still retain organic evidences of the fact in the shape of fossil-bearing beds, and the discovery of such deposits would confirm or confute such speculations as these. The key to the geological problem lies within the Antarctic Circle, and to find it would be to recover some of the past history of the southern hemisphere. There is no reason to despair of discovering such evidence, as Dr. M'Cormack, in his account of Ross's voyage, records that portions of Victoria Land were free from snow, and therefore available for investigation, besides which their surface may still support some living forms, for they cannot be colder or bleaker than the peaks which rise out of the continental ice of North Greenland; and these, long held to be sterile, have recently disclosed the existence upon them of a rich though humble flora.

We have now to consider some important meteorological questions. If we look at the distribution of the atmosphere around the globe, we shall see that it is spread unequally. It forms a stratum which is deeper within the tropics than about the poles, and over the northern than over the southern hemisphere, so that the barometer normals fall more as we approach the Antarctic than they do when we near the Arctic. Maury, taking the known isobars as his guide, has calculated that the mean pressure at the north pole is 29.1,

but that it is only 28 at the south (Maury's *Meteorology*, p. 259). In other words, the Antarctic Circle is permanently much barer of atmosphere than any other part of the globe. Again, if we consult a wind-chart, we shall see that both poles are marked as calm areas. Each is the dead centre of a perpetual wind-vortex, but the south-polar indraught is the stronger. Polarward winds blow across the 45th degree of north latitude for 189 days in the year, but across the 45th degree of south latitude for 209 days. And while they are drawn in to the north pole from over a disk-shaped area 5,500 miles in diameter, the south-polar indraught is felt throughout an area 7,000 miles across. Lastly, the winds which circulate about the south pole are more heavily charged with moisture than are the winds of corresponding parts of the other hemisphere. Now, the extreme degree in which these three conditions—of a perpetual grand cyclone, a moist atmosphere, and a low barometer—co-operate without the Antarctic, ought to produce within it an exceptional meteorological state; and the point to be determined is, what that condition may be. Maury maintained that the conjunction will make the climate of the south-polar area milder than that of the north. His theory is, that the saturated winds, being drawn up to great heights within the Antarctic, must then be eased of their moisture, and that simultaneously they must disengage vast quantities of latent heat; and it is because more heat must be liberated in this manner in the south-polar regions than in the north, that he infers a less severe climate for the Antarctic. He estimates that the resultant relative differences between the two polar climates will be greater than that between a Canadian and an English winter (Maury's *Meteorology*, p. 466). Ross reports that the south-polar summer is rather colder than that of the north, but still the southern winter may be less extreme, and so the mean temperature may be higher. If we examine the weather reports logged by Antarctic voyagers, instead of the temperature merely, the advantage still seems to rest with the south. In the first place, when the voyager enters the Antarctic, he sails out of a tempestuous zone into one of calms. To demonstrate the truth of this statement, I have made an abstract of Ross's log for the two months of January and February, 1841, which he spent within the Antarctic Circle. To enable every one to understand it, it may be well to explain that the wind-force is registered in figures from 0, which stands for a dead calm, up to 12, which represents a hurricane. I find that during these 60 days it never once blew with the force 8; that is, a fresh gale. Only twice did it blow force 7, and then only for half a day each time. Force 5 to 6—fresh to strong breezes—is logged on 21 days. Force 1 to 3—that is, gentle breezes—prevailed on 34 days. The mean wind-force registered under the entire 60 days was 3.43; that is, only a four to five knot breeze. On 38 days blue sky was logged. They never had a single fog, and on 11 days only was it even misty. On the other hand, snow fell almost every second day. We find such entries as these: "Beautifully clear weather," and "Atmosphere so extraordinarily clear that Mount Herschel, distant 90 miles, looked only 30 miles distant." And again, "Land seen 120 miles distant, sky beautifully clear." Nor was this season exceptional, so far as we can tell; for Dr. McCormack, of the "Erebus," in the third year of the voyage, and after they had left the Antarctic for the third and last time, enters in

his diary the following remark. He says, "It is a curious thing that we have always met with the finest weather within the Antarctic Circle; clear, cloudless sky, bright sun, light wind, and a long swell" (McCormack's *Antarctic Voyage*, v. i. p. 345). It would seem as if the stormy westerlies, so familiar to all Australian visitors, had given to the whole southern hemisphere a name for bad weather, which as yet, at least, has not been earned by the south-polar regions. It is probable, too, that the almost continuous gloom and fog of the Arctic (Scoresby's *Arctic Regions*, pp. 97 and 137) in July and August have prejudiced seamen against the Antarctic summer. The true character of the climate of this region is one of the problems awaiting solution. Whatever its nature may be, the area is so large and so near to us, that its meteorology must have a dominant influence on the climate of Australia; and on this fact the value of a knowledge of the weather of these parts must rest.

To turn to another branch of science, there are several questions relating to the earth's magnetism which require for their solution long-maintained and continuous observations within the Antarctic Circle. The mean or permanent distribution of the world's magnetism is believed to depend upon causes acting in the interior of the earth, while the periodic variations of the needle probably arise from the superficial and subordinate currents produced by the daily and yearly variations in the temperature of the earth's surface. Other variations occur at irregular intervals, and these are supposed to be due to atmospheric electricity. All these different currents are excessively frequent and powerful about the poles; and a sufficient series of observations might enable physicists to differentiate the various kinds of currents, and to trace them to their several sources, whether internal, superficial, or meteoric. To do this properly, at least one land observatory should be established for a period. In it the variation, dip, and intensity of the magnetic currents, as well as the momentary fluctuations of these elements, would all be recorded. Fixed term days would be agreed on with the observatories of Australia, of the Cape, America, and Europe; and during these terms a concerted continuous watch would be kept up all round the globe to determine which vibrations were local, and which general.

The present exact position of the principal south magnetic pole has also to be fixed, and data to be obtained from which to calculate the rate of changes, in the future; and the same may be said of the foci of magnetic intensity and their movements. In relation to this part of the subject, Capt. Craik recently reported to the British Association his conclusions in the following terms. He says, "Great advantage to the science of terrestrial magnetism would be derived from a new magnetic survey of the southern hemisphere, extending from the parallel of 40° south as far towards the geographical pole as possible."

Intimately connected with terrestrial magnetism are the phenomena of auroras. Their nature is very obscure, but quite recently a distinct advance has been made towards discovering some of the laws which regulate them. Thanks to the labors of Dr. Sophus Tromholdt, who has spent a year within the Arctic Circle studying them, we now know that their movements are not as eccentric as they have hitherto appeared to be. He tells us that the Aurora Borealis, with its crown of many lights, encircles the pole obliquely, and

that it has its lower edge suspended above the earth at a height of from 50 to 100 miles; the mean of 18 trigonometrical measurements, taken with a base-line of 50 miles, being 75 miles. The aurora forms a ring round the pole, which changes its latitude four times a year. At the equinoxes it attains its greatest distance from its pole, and at midsummer and midwinter it approaches it most closely, and it has a zone of maximum intensity which is placed obliquely between the parallels of 60° and 70° north. The length of its meridional excursion varies from year to year, decreasing and increasing through tolerably regular periods, and reaching a maximum about every eleven years, when also its appearance simultaneously attains to its greatest brilliancy. Again, it has its regular yearly and daily movements or periods. At the winter solstice it reaches its maximum annual intensity; and it has its daily maximum at from 8 P.M. to 2 A.M., according to the latitude. Thus at Prague, in 50° north latitude, the lights appear at about 8.45 P.M.; at Upsala, 60° north latitude, at 9.30 P.M.; at Bosskop, 70° north, at 1.30 A.M. Now, while these data may be true for the northern hemisphere, it remains to be proved how far they apply to the southern. Indeed, seeing that the atmosphere of the latter region is moister and shallower than that of the former, it is probable that the phenomena would be modified. A systematic observation of the Aurora Australis at a number of stations in high latitudes is therefore desirable.

Whether or not there is any connection between auroral exhibitions and the weather is a disputed point. Tromholdt believes that such a relationship is probable (*Under the Rays*, 1,283). He says, that, "however clear the sky, it always became overcast immediately after a vivid exhibition, and it generally cleared again as quickly" (*Under the Rays*, 1,235). Payer declares that brilliant auroras were generally succeeded by bad weather (*Voyage of Tegelhoff*, 1324), but that those which had a low altitude and little mobility appeared to precede calms. Ross remarks of a particular display "that it was followed by a fall of snow, as usual" (*Ross's Voyage*, 1312). Scoresby appears to have formed the opinion that there is a relationship indicated by his experience. It is therefore allowable to regard the ultimate establishment of some connection between these two phenomena as a possible contingency. If, then, we look at the eleven-year cycle of auroral intensity from the meteorological point of view, it assumes a new interest; for these periods may coincide with the cycles of wet and dry seasons, which some meteorologists have deduced from the records of our Australian climate, and the culmination of the one might be related to some equivalent change in the other; for if a solitary auroral display be followed by a lowered sky, surely a period of continuous auroras might give rise to a period of continuous cloudy weather, with rain and snow. Fritz considers that he has established this eleven-year cycle upon the strength of auroral records extending from 1583 to 1874, and his deductions have been verified by others.

In January, 1886, we had a widespread and heavy rainfall, and also an auroral display seen only at Hobart, but which was sufficiently powerful to totally suspend communication over all the telegraph-lines situated between Tasmania and the China coast. This sensitiveness upon the part of the electric currents to auroral excitation is not novel, for long experience on the telegraph-wires of Scandinavia

has shown that there is such a delicate sympathy between them that the electric wires there manifest the same daily and yearly periods of activity as those that mark the auroras. The current that reveals itself in fire in the higher regions of the atmosphere is precisely the same current that plagues the operator in his office. Therefore in the records of these troublesome earth-currents, now being accumulated at the Observatory by Mr. Ellery, we are collecting valuable data, which may possibly enable the physicist to count the unseen auroras of the Antarctic, to calculate their periods of activity and lethargy, and again to check these with our seasons. But it need hardly be said that the observations which may be made in the higher latitudes, and directly under the rays of the Aurora Australis, will have the greater value, because it is only near the zone of maximum auroral intensity that the phenomena are manifested in all their aspects. In this periodicity of the southern aurora I have named the last scientific problem to which I had to direct your attention; and I would point out, that, if its determination should give to us any clew to the changes in the Australian seasons which would enable us to forecast their mutations in any degree, it would give to us in conducting those great interests of the country which depend for their success upon the annual rainfall an advantage which would be worth, many times over, all the cost of the expeditions necessary to establish it.

Finally, there is a commercial object to be served by Antarctic exploration, and it is to be found in the establishment of a whaling trade between this region and Australia. The price of whalebone has now risen to the large sum of \$10,000 a ton, which adds greatly to the possibilities of securing to the whalers a profitable return. Sir James Ross and his officers have left it on record that the whale of commerce was seen by them in these seas, beyond the possibility of a mistake. They have stated that the animals were large and very tame, and that they could have been caught in large numbers. Within the last few years whales have been getting very scarce in the Arctic; and in consequence of this two of the most successful of the whaling-masters of the present day, Capts. David and John Gray of Peterhead, Scotland, have devoted some labor to collecting all the data relating to this question, and they have consulted such survivors of Ross's expedition as are still available. They have published the results of their investigations in a pamphlet, in which they urge the establishment of the fishery strongly, and they state their conclusions in the following words: "We think it is established beyond doubt that whales of a species similar to the right or Greenland whale found in high northern latitudes exist in great numbers in the Antarctic seas, and that the establishment of a whale-fishery within that area would be attended with successful and profitable results." It is not necessary for me to add any thing to the opinion of such experts in the business. All I desire to say is, that if such a fishery were created, with its headquarters in Melbourne, it would probably be a material addition to our prosperity, and it would soon increase our population by causing the families of the hardy seamen who would man the fleet to remove from their homes in Shetland and Orkney and the Scotch coasts, and settle here.

In conclusion, I venture to submit that I have been able to point to good and substantial objects, both scientific and

commercial, to justify a renewal of Antarctic research; and I feel assured that nothing could bring to us greater distinction in the eyes of the whole civilized world than such an expedition, judiciously planned, and skilfully carried out.

THE USE OF OIL.

MASTERS of vessels cannot be reminded too often of the use of oil in stormy weather. Its importance is well illustrated by the fact that it is now referred to at length in standard books on seamanship; and the International Marine Conference at Washington recommended that "the several governments require all their sea-going vessels to carry a sufficient quantity of animal or vegetable oil for the purpose of calming the sea in rough weather, together with suitable means for applying it." As a good example of the directions that are now given for the best way to use oil, the remarks in a recently published book on practical seamanship, by Todd and Whall, printed on the "Atlantic Pilot Chart" for October, are of interest:—

"To cross a bar in heavy weather, after battening down all hatches, etc., take two pieces of India-rubber pipe about twenty feet long and one inch in diameter. Put these through the hawse-pipes, one on each side, and let their ends trail in the sea. On the upper end of each piece of tube lash a good-sized funnel, secure it to a stanchion in a vertical position, and station a man at each, with a three-gallon tin of colza-oil. When the vessel enters the outermost sea that breaks on the bar, let each man gently pour the oil down the pipes. This will smooth the bar immensely, and the vessel will steer much better. Almost any oil of animal or vegetable origin will do; but petroleum is not of much service, excepting to mix with and thin the other, if necessary. When lying to in a gale, head to wind and drifting slowly, if a little oil is used, a ship ought to pull through the heaviest storm. Running in a gale, an oil-bag hung over the weather-side, or oil poured down a pipe well forward, is of great service in preventing the sea from breaking aboard; gale increasing, to round-to, prepare a sea anchor, watch for a smooth spell, and then put the helm down, heave overboard a few gallons of oil, and float the sea-anchor. Keep pouring the oil on the sea down a weather pipe or scupper while the ship is coming up to the wind. A well-equipped sailing-ship, even if deeply laden, will lie to under a closely reefed topsail or tarpaulin in the rigging, and weather almost any gale, so long as she is not taken aback. Sailing-vessels under these circumstances nowadays often use an oil-bag paid out to windward to smooth the sea still more: this is the ideal position of a laden vessel in a dangerous storm. Whilst towing a disabled ship over a bar, or where the sea is very wicked, a couple of oil-bags over the stern will ease the sea on the tow. In a good steamer, to take a shipwrecked crew off a wreck, run to windward of the wreck, lower the lee boat, put your vessel head to sea and dead to windward, and let the boat drop down toward the wreck, veering out on the line, and constantly pouring considerable oil into the sea, which will keep the sea smooth between your ship and the wreck. In using oil-bags in heavy weather, they should be weighted, if hung over the side, in order to keep them down. When scudding, it is best to pour the oil down the closet-pipes."

NOTES AND NEWS.

WE learn from *Nature* that an expedition to Greenland will start from Denmark next year, under the command of Lieut. Ryder, to investigate the east coast between latitude 66° and 73°.

—At a meeting of the Royal Geographical Society of Australasia, held at Melbourne on Aug. 22, a letter from Sir Thomas Elder was read, in which he offered to bear the entire cost of an expedition to the unexplored regions of Australia. A report on the question of antarctic exploration was also submitted to the meeting. In this report, according to *Nature* of Oct. 9, it was stated that public interest in the subject had been revived by the announcement that Baron A. E. Nordenskiöld, after a conference with his friend Baron Oscar Dickson, had consented to take the

command of an expedition to the south-polar regions, on the condition that the Australian colonies contributed a sum of \$25,000 towards the expenses. Baron Dickson having offered to advance the other moiety, or whatever more might be necessary. "The offers were cordially accepted, and the antarctic committee felt itself justified in making the necessary arrangements without delay for collecting the amount to be contributed by the Australasian colonies. The council of the society had passed resolutions recognizing a national duty in the exploration of the antarctic regions, especially that portion lying opposite to Australasia, pledging itself to use its influence in promoting the enterprise, and giving authority to head a subscription list in aid of the Swedish Australian Exploration Fund with a donation of \$1,000 from the society's funds. It would appear, from the hearty reception accorded to the proposals of the antarctic committee, that the latter might rely upon the energetic co-operation of all the scientific societies of Australasia, and thus be enabled to collect the amount of the contribution promised towards defraying the expenses of the combined Swedish and Australian Exploring Expedition to the South Polar Regions." The report, on being put to the meeting, was "received with acclamation."

—Mr. Robert Swordy of Dryburn Cottage, Durham, in a letter to *Nature*, the substance of which was printed in that journal for Oct. 9, gives an account of a toad (*Bufo vulgaris*) which he saw crawling out of the Pond Wood at Aykleyheads. The muscles of the toad's body were (as usual) arranged in such a fashion that the back of the toad looked like minute nodules of dark gravel embedded in a damp path below trees; but what seemed to Mr. Swordy most remarkable was, that on the top of this gravel-like arrangement of muscles there was spread a mesh or network of very fine lichen, with oval-shaped leaves of a lightish-green color, connected more or less to each other by a hair-like process of stems. This lichen spread irregularly over the toad's back, and odd sprays of it were also to be seen on the legs and upper surfaces of the feet. "Now," says the writer, "had the toad been in its regular haunts under the trees and shrubs, with this wonderful counterfeit of gravel and protective coloring, it would have been almost impossible to discriminate its form from the dark gravel, lichens, moss, wood-sorrel, and dead leaves of the place; and I doubt not that this animal's unobtrusive attire would aid it materially in capturing the insects necessary for its sustenance." Mr. Swordy enclosed photographs of the toad sitting on a section of lichen-colored gravel path, taken from near the spot where he found it.

—The following newspaper anecdote will interest those fond of animals: "A friend of the writer owns a monkey, which answers to the name of 'Jocko.' The children of the house and Jocko are boon companions, and of a summer afternoon enjoy a frolic together upon the lawn. One day some one threw a match down, and the grass ignited, making a little blaze. Jocko saw it, stopped and looked, then glanced all around, and, seeing a piece of plank not far off, ran for it, crept cautiously to the fire, all the time holding the plank as a shield between himself and the flame, then threw the plank on the fire and pressed it down and extinguished it. What child could have reasoned better and done more? Although, perhaps, no danger could have come from the fire, still, no one knows what the result might have been, and the monkey evidently believed that prudence is the better part of valor."

—The students' work in psychology at the University of Toronto, as reported by Professor J. Mark Baldwin in the last number of *The American Journal of Psychology*, has been hitherto general and theoretical. The new curriculum, however, as now ratified by the university senate, provides for more special and advanced courses, and opportunity for research. The recent fire in University College postponed the equipment of the psychological laboratory, but in the plans for the new buildings more ample accommodations are secured. The new laboratory is to be in the restored building in a retired portion of the first floor immediately over the rooms of the physical department. It will comprise two communicating working rooms, each 16 by 21 feet; a professor's private room, to be used also as a special psychological library under charge of a fellow or instructor; and a dark room available

from the resources of the physical laboratory. The first two rooms will be separated by a hall from the latter two. The equipment, apparatus, etc., may be delayed in consequence of the present severe tax upon the resources of the university, but special researches will be prosecuted with the aid of adapted apparatus kindly loaned from the very complete collections of the departments of physics and biology. The design is to encourage serious endeavor and stimulate interest in the outlying questions of the sciences, principally among post-graduates. Private facilities will be given whenever possible for experiments in psychometry and psychophysics. It is hoped that the work may be expanded to include problems in medical and abnormal psychology, since the city and provincial institutions present abundant facilities; but nothing in this line has been projected as yet. During the past year the students of the department have formed a psychological society for discussion and presentation of papers, conducted entirely by themselves. The object of the society is breadth of information rather than new work. They treat psychological questions, however, quite apart from speculative philosophy. The library was totally destroyed by the fire; but the new collection is growing rapidly, especially in this department, owing to the notable generosity of friends at home and abroad. In another year it will probably be more complete in psychological publications than before. The teaching force is at present Professor J. Mark Baldwin and a fellow. After next year Professor J. G. Hume is to assume his duties, and a post graduate scholarship in philosophy is to be established in memory of the late Professor Young. Thus four, at least, will be the official in charge. The following are the subjects of researches now in progress: "Beginnings of Voluntary Movement in Childhood," "Sense of Effort," "Recognition," together with special topics for Professor Baldwin's proposed volume on "Feeling and Will."

—Following the appropriation and authority of Congress for its action, the Mississippi River Commission, after about a year of suspended business, held its first meeting of the present fiscal year at the Army Building in New York City, at which all the members of the board were present, beginning on the morning of Oct. 1, and continuing until the afternoon of the 4th. The first days of the session were given to the public hearing of parties interested in the protection and improvement of the Mississippi River, represented by the State engineers, and organized bodies of citizens, mainly from the lower sections of the river, together with a more general discussion by other parties of the commercial and economic questions relating to the entire valley. The latter part of the time was given, in private session, to the direct business of the commission, in allotting the appropriation made by Congress—three million two hundred thousand dollars—to the various works of protection and improvement on the river. Since the first organization of the commission, some changes have taken place in its *personnel*, and it now consists of the following members: Col. Cyrus B. Comstock, Corps of Engineers, president (Army Building, New York City); Lieut. Col. Charles R. Suter, Corps of Engineers, U.S.A. (St. Louis, Mo.); B. M. Harrod, civil engineer (New Orleans, La.); Hon. Robert S. Taylor (Fort Wayne, Ind.); Major Oswald H. Ernst, Corps of Engineers, U.S.A. (War Department, Washington, D.C.); Henry Flad, civil engineer (St. Louis, Mo.); Professor Henry L. Whiting (U. S. Coast and Geodetic Survey, Washington, D.C.); Capt. Carl F. Palfrey, Corps of Engineers, U.S.A., secretary of the commission (with main office at St. Louis, Mo.). The next meeting is to be held on board the government steamer "Mississippi" at St. Louis, whence the commissioners will proceed on an inspection of the river, and the parties carrying on the various works along its course between Cairo and the Head of the Passes.

—A valuable contribution to the subject of atmospheric electricity has been lately made by Professor L. Weber, who, in experiments at Breslau, used a sensitive, earth-connected galvanometer, instead of the electroscope in Exner's method, as we learn from *Nature* of Oct. 9. Using Exner's metallic rod and flame, he found that the currents were extremely small, about a micro-milliampère (or the thousand-millionth part of an ampère). They were increased with a longer rod and bigger flame; but much

better results were got with a kite or captive balloon. The edge of the kite was coated with silver paper, and the tail was formed with tassels of the paper. A line of fine steel wire was used, and about twelve feet at the upper end were of non-conducting string. Experiments were made on twelve cloudless days. Taking the intensities of current as ordinates, and the heights to which the kite (or balloon) rose as abscissæ, the curve of intensity had its convex side to the axis of abscissæ. On but few days was the current negative, this effect being probably due, the author thinks, to dust charged with negative electricity which it gave to the line. This might neutralize some of the positive electricity set flowing in the wire by the earth's induction. Professor Weber considers that any experiments on the earth's surface with short conductors can at best give relative values, and determine periodical changes. His values differ not inconsiderably from Exner's. At a height of 350 metres (1,166 feet) the potential was found to be 96,400 volts; and, assuming a regular increase of potential with height, the fall of potential would here be 275 volts. The potential of the earth is estimated at the enormous value of $1,720 \cdot 10^6$ volts. Supposing the volt to be about the electro-motive force of a Daniell element, a huge battery of this number of elements would be needed to produce the earth's potential; the zinc pole being connected with earth, and the copper led into space. Professor Weber considers the question of possible electric repulsion from the earth, and is led to some instructive remarks on rain-particles, clouds, etc. Some very interesting effects were obtained from thunder-clouds; but for these and other matters we would refer the reader to the original (an account of these researches appears in *Humboldt* for September).

—Naturalists will read with interest a paper in *Humboldt* for September, in which Professor Forel of Zürich gives the results of a visit he paid to Tunis and eastern Algeria, chiefly to observe the ants there. Looking from a ship at the dreary gray wastes, and the large date-palm oasis of Gabes, according to *Nature*, one fancies all animal life must be concentrated under the palms. But really there is very little of it there, and hardly any thing singular; while the sand of the desert contains, round each of the poor, small, sparse plants, a host of beetles and other insects, many of them with striking adaptations and peculiarities. Some live on excrement of camels, asses, etc.; some on the plants; and some prey on other animals, big and small. In one ant-hill he found that several ants had a small brown object clinging to the lower part of an antenna; in some cases, one on either antenna. On examination, this fell off, and was found to be a small beetle, which evidently clings there as guest. It has tufts of hair, which are probably licked by the ant. The host did not seem to trouble itself about this little creature, which, by its odd post, is enabled to accompany the ant in its wanderings and changes of abode. Professor Forel remarks on the peaceful character of the ants in that region. With few exceptions they avoid fighting, and only one ant was found capable of piercing the human skin.

—The phenomenon of globular lightning was imitated by M. Planté, it will be remembered, with his secondary batteries. It has been shown by Herr von Lepel, as we learn from *Nature* of Oct. 16, that this can also be done with so-called static electricity, obtained from an influence machine. Two thin brass-wire points from the poles of a powerful machine being held at a certain distance from the opposite sides of an insulated plate of mica, ebonite, glass, or the like, there appear small red luminous balls, which move about, now quickly, now slowly, and are sometimes still. Even better effects were had with a glass or paper disk which had been sprayed with paraffine. Small particles of liquid or dust seem to be the carriers of the light. A slight air-current makes the spherules disappear with hissing noise. These spherules, the author remarks, are phenomena of weak tension: an increase of the tension gives a rose spark-discharge. Various interesting analogies with globular lightning are traced.

—In *Science* of last week, p. 248, first column, 20th line, "efferent sensations" should read "afferent sensations;" 21st line, "Memories of movements" should read "Memories of movement;" 22d line, "afferent feeling" should read "efferent feeling."

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.

Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XVI. NEW YORK, NOVEMBER 7, 1890. No. 405.

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THE CULMINATING POINT OF THE NORTH AMERICAN CONTINENT.¹

AMONG the objects for which the expedition recently organized under the auspices of the Academy of Natural Sciences of Philadelphia was despatched to Mexico was the determination of the physical features of the giant volcanoes of the South, with special reference to a study of the vertical distribution of animal and vegetable forms. While prosecuting our observations in this direction, I took the opportunity, in company with one or more of my associates, of scaling the four loftiest summits of the land; namely, the peak of Orizaba, Popocatepetl, Ixtaccihuatl, and the Nevado de Toluca. This gave me the advantage of making personal comparisons between the life that existed in different regions of "cloud-land," at the same time that it offered me the opportunity of more closely investigating the geological features of some of the most gigantic volcanic mountains known to us. Numerous measurements of altitude were made during the ascents, and, in the higher regions, always with the same instrument. This was a registered aneroid, tested and corrected at Philadelphia (imme-

diately before the starting, and shortly after the return of the expedition) at the sea-level of Vera Cruz, and in the Central Meteorological Observatory of the City of Mexico, at an elevation of 7,403 feet. To the officers of the latter institution I am indebted for the privilege of making comparisons with the standard mercurial column.

The results of our measurements show a striking accord in some instances with those obtained from earlier measurements, while in other cases they exhibit marked divergence. The fact that all the summits were ascended within a period of three weeks, were measured with the same instrument, and during a period of atmospheric equability and stability which is offered to an unusual degree by a tropical dry season, renders the possibility of errors of any magnitude almost *nil*. At any rate, such errors as may have crept in will probably not affect a general comparative result. The points of important difference are: (1) the highest summit of Mexico is not, as is commonly supposed, Popocatepetl, but the peak of Orizaba (Citlaltepetl, the "Star Mountain"), which rises 700 feet higher (18,200 feet); (2) Ixtaccihuatl, the familiar "White Woman" of the plain of Anahuac, is but a few hundred feet (about 550) lower than Popocatepetl.

The peak of Orizaba was ascended on the 6th and 7th of April, Popocatepetl on the 16th and 17th of the same month, the Nevado de Toluca on the 21st, and Ixtaccihuatl on the 26th and 27th.

The restoration of the peak of Orizaba to the first place among Mexican mountains, and its increased altitude, open up the interesting question as to what constitutes the culminating point of the North American continent. The only other mountain that need be considered in this connection is St. Elias, situated approximately on the 141st meridian of west longitude, and whose summit is claimed for both the possessions of Great Britain and the United States (Alaska). The measurements of this mountain depart so widely from one another, however, that we are not yet in a position to affirm, even within limits of a thousand feet or considerably more, how nearly it approaches in height the Mexican volcanoes. We are probably justified in dismissing without further examination the measurement made by La Pérouse in 1786, which gave for the peak less than 13,000 feet; and seemingly not much more reliable is the datum (14,970 feet) which appears in Capt. Denham's chart from 1853 to 1856, and is copied into the British Admiralty chart of 1872 (Humboldt's *Cosmos*, v. p. 419, Otté's edition; Dall, *Report of the United States Coast and Geodetic Survey for 1875*, p. 159). This latter figure (4,562 metres) is adopted by Petermann in his general map of North America prepared for Stieler's "Hand-Atlas" (1878-81). Malespina in 1791 determined the height, by means of angles taken from near the position of Port Mulgrave, to be 5,441 metres, or 17,851 feet; and the equivalent of this figure has been copied into the Russian hydrographic charts (1847). Tebenkoff reduces this amount by somewhat over 900 feet.

No carefully conducted measurements of the mountain appear to have been made between the date of the publication of Tebenkoff's chart (1849) and 1874, when Mr. Dall, under the direction of the United States Coast Survey, surveyed a considerable portion of the Alaskan region.¹ This investigator found four different values for the height of the mountain as measured from four points respectively 69, 127, 132, and 167 miles distant: these are 19,464, 18,350, 19,956, and 18,033 feet. Mr. Dall dismisses all of these as having little value, except the measurement of 19,464 feet, made from Port Mulgrave. It is difficult to reconcile the

¹ From the Proceedings of the Academy of Natural Sciences of Philadelphia.

¹ Mr. Dall, in his report above referred to (p. 159), quotes from Leopold von Buch an additional measurement of the mountain, namely, 16,758 feet. Grewingk (Verhandl. Russ.-Kaiser. Mineralg. Gesellsch., 1848-49 [1850], p. 99) gives the same figure, referring likewise to Buch (Canar. Inseln, p. 390); and a further reference appears in Davidson's Coast Pilot of Alaska, 1869, p. 142, note (16,754 feet, according to Grewingk). But this figure is manifestly Malespina's measurement given in French feet, which resolved is equal to 17,880 feet; and Grewingk himself quotes Malespina's measurement (5,441 metres) on p. 404 of his report. Humboldt (*op. cit.* v. p. 252) credits the measurement of 17,855 feet to Quadra and Galeano; but, as these observers were associated with Malespina, it is more than probable that the data here given are those which have been generally attributed to Malespina. Humboldt intimates that the measurement is perhaps one-fifteenth too great; but whether this assertion rests on certain facts contained in Malespina's manuscripts, which the great German traveller found among the Archives of Mexico (p. 419), or not, is not stated.

vast range of these measurements, whose extremes vary to an extent of upwards of 1,900 feet, or to one-tenth of the height of the entire mountain, except on the assumption that the angles of measurement were too small to permit of exactitude in the result. And, indeed, Mr. Dall himself rejects all his measurements except those made from Port Mulgrave, giving them "no weight in the result, as they were all taken at great distances from the peak, and subject to various disturbing influences and uncertainty in most of the positions" (p. 164). And yet it is upon the accurate determination of the position "At Sea," 127 miles distant, that "the position of Mount St. Elias depends" (p. 165); and necessarily upon the determination of this position must also depend the accuracy of the measurement of height. Malespina's measurement was made from a point apparently very close to that occupied by the Coast Survey officers, and his results, as has already been seen, vary negatively by 1,600 feet; but he estimated the distance separating him from the mountain at 55.1 nautical miles. Mr. Dall remarks, in relation to the discrepancy existing between the two measurements, that the doubt lies wholly with the distance. But this does not explain the great range in Mr. Dall's own results. And we are perhaps led to be the more suspicious regarding the value of these when we take into account the discrepancies which appear in the determination of the altitude of Mount Fairweather. Three series of sextant observations were made of this mountain from the region about Lituya Bay and Cape Spencer, with the result of obtaining an average value of 15,447 feet. Vertical circle measurements of the same mountain made from Port Mulgrave indicate 15,270 feet, while the average of all measurements is 15,423 feet. Mr. Dall calls attention to the close correspondence of these results, and comments more particularly upon the "unanimity in the Lituya Bay observations."¹ A reference to the exact results obtained, without recourse to the delusive system of extracting averages, shows, however, that in place of unanimity we have the reverse. Thus, the sextant observations taken from "Off Cape Spencer" indicate 16,009 feet; those from "Off Lituya Bay," 15,247 feet; and those from "Off Lituya," 15,085 feet (*op. cit.* p. 174),—a difference in extremes of upward of 900 feet. This divergence in the measurement of a mountain three miles ($\pm$) in height from positions twenty to fifty miles distant makes very doubtful the results obtained in the case of St. Elias, where the distances were still very much greater, and the angles of observation correspondingly smaller.

In view of the broad divergence existing in these later measurements, and the fact that all earlier determinations give less than 18,000 feet for the height of Mount St. Elias, geographers will probably consider the question of absolute height as still an open one. That the mountain closely approximates the giants of the Mexican plateau is almost certain; but it seems equally probable that its true position is after, and not before, the peak of Orizaba.

ANGELO HEILPRIN.

THINNESS VERSUS STOUTNESS.

THE following facts on the value of emaciation, from the *Lancet* of Sept. 27, are of interest. Emaciation is a prominent feature in many diseases. Many of the phenomena of disease are, in reality, efforts at repair. It will therefore be advantageous to inquire if some good purpose is not served by emaciation. To begin with diseases which affect the circulation, in many such we may note that the patient will rapidly lose flesh, and that when the loss has proceeded to a certain degree it is arrested. The patient becomes and continues thin. Not only is it difficult to fatten him, but he is not much benefited by the attempt. Should his disease be arrested, but leave some injury behind, the patient will probably continue thin. Instinctively, in consequence, we look for the presence of disease, active or quiescent, in sparsely developed persons; and practically we look for it in the territory of the circulation, either pulmonary or systemic, and generally find something. Such emaciation, ceasing at a certain point, does not much exceed what is seen in athletic training, and may be defined as an involuntary training, forced upon the patient by his ailment. What,

briefly, is the benefit of training? Unusual effort in untrained men or animals is checked, not by muscular exhaustion, but by congestion of the pulmonary circulation, and paralysis of the right ventricle of the heart. The effect of training is to enable the pulmonary circulation to keep pace with the increased activity of the systemic. Several changes concur to this end,—dilatation of the lung and of its blood-vessels, hypertrophy of the right side of the heart, and most especially absorption of every tissue which is found to be superfluous for the effort in view. This absorption reduces the area of the systemic circulation; and it is followed by a reduction in the quantity of blood, because a smaller quantity will suffice for active circulation through the lesser area. The individual so trained is in the condition of having a pulmonary territory larger than is necessary for his state of rest, and consequently with a greater margin for relief upon exertion. Conversely, the contrary condition of obesity develops the systemic circulation to the full capacity of the lungs, so that the least exertion will produce dyspnoea. Acute disease being like exertion, we can see the advantage of entering upon it in a state of training. The exhaustion to be feared is that of the heart's right ventricle; and the inconvenience of existing stimulants is, that they do not stimulate the right ventricle by itself.

To return to emaciation as produced by disease. Let us first take the case of diseases of the lung. Should the territory of the pulmonary circulation be diminished by such a disease as phthisis, it would be impossible for the patient, without emaciation, to have an active circulation in the systemic area without danger of congestion of the lung. The feeble attempts that are made at hypertrophy of the lung in this disease are thus met half way. The same thing is true of all emphysema of the lungs, whether senile or morbid. Then we may consider the disorders of the greater circulation. In disease of the valves, when the muscle has to do the work of the valves, and in decay of the aorta, when the ventricle has to combine the aorta's duty with its own, the smaller the volume of blood to be dealt with, the better. Without reduction of the area through which it flows, a reduced amount of blood would only result in a sluggish circulation. Emaciation in such cases is therefore salutary. Moreover, the capillaries are the seat of greatest friction: they are therefore the part to be reduced. This is the reason why all animals, in a state of nature, grow thin as they grow old. Man, and the creatures under his control, may violate this law, but not with impunity. Acute disease, when the arteries are decayed, is doubly dangerous. The right ventricle of the heart may be exhausted, as before, but now the left ventricle may also prove unequal. Stimulants here can have but little drawback; but in surplus lung, and an amount of blood that is well within the powers of propulsion, lies a greater safety. Obesity is dangerous to the aged.

It would be well to consider the phenomena of waste in fever by the light of an assumption that they are salutary. The brute creation, when suffering from fever, eat nothing; yet they do not die, but recover. The body seems destined to feed upon itself, and to delay all repair until convalescence. Great responsibility rests upon those who supersede this instinct by an artificial method. Graves, who fed fevers, at the same time bled his patients. Venesection has this drawback, that to relieve the right heart we are obliged to stint the left, and to reduce the systemic circulation to a sluggish flow. The speedy repair of such loss of blood shows that its benefit must be only temporary. Such a remedy is an imperfect substitute for a capacious lung. The perception of this inconvenience has led to the disuse of bleeding. The concomitant pressing of food in fevers should probably follow it. The most evident of natural remedies for any kind of fever are starvation and emaciation. However indulgent appetite may be in health, it returns in disease to the strictest authority. Obedience to its dictates may shatter superstitions, but will not jeopardize the cure. In chronic diseases, the physician who thinks of the future of his patient will look grudgingly on fat. It provides for warmth and irregularity of nutrition. If these be provided for in other ways, much relief can be given to the circulation; and if in acute disease the presence of a tissue should prove an embarrassment, the physician will not interfere with its removal.

¹ Including here the measurements made off Cape Spencer.

LETTERS TO THE EDITOR.

. Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Structure of the Plesiosaurian Skull.

It is somewhat remarkable, that, in a group of fossil reptiles like the plesiosaurs, the nature and structure of the skull should have remained for so long a time practically unknown. Fragmentary remains of this very important part of the skeleton are not rare in collections, but none sufficiently complete to make out any thing at all satisfactory of its anatomy have hitherto been described. Very fortunately the museum of the Kansas University has recently been enriched by the skull and a large part of the neck of one of these animals, in most remarkably perfect preservation, collected from the Kansas Niobrara cretaceous by Judge E. P. West, assistant in paleontology at the State University. Recognizing the value and rarity of the specimen, Mr. West used the most scrupulous care in removing and shipping the specimen, and, as now cleaned from its matrix in the museum, it permits most of its structure to be made out with certainty and ease. I have in preparation a full description of the specimen, with illustrations, which will shortly be published in the "Transactions of the Kansas Academy of Sciences." Meanwhile, however, the very great importance of the find renders a brief description of its chief characters at the present time very desirable.

The species I refer provisionally to the genus *Cimoliosaurus*, though certain characters, as will be seen, do not accord with those given by Lydekker in his recent "Catalogue of Fossil Reptilia." The specimen lies upon its side, with twenty-six vertebrae in position; and all, save some of the posterior vertebrae, which were exposed, are in perfect preservation. The cervical vertebrae have the arches and riblets fully co-ossified with no or but very slight traces of their sutural attachments. There is but a single rib attachment, and the zygosphenes are rudimentary. The spines are short; the anterior centra, gently cupped; the posterior ones, which increase gradually in slenderness, more deeply so. The parietal bone forms a roof-shaped covering, ascending into a high, thin sagittal crest two or three inches above the brain-case: there is no parietal foramen. There is but one temporal arcade, a broad bar passing directly backward, on a line with the maxilla, to unite with the lower part of the quadrate. The limits of the quadrato-jugal have not yet been satisfactorily made out. The post-orbital is a slender bone uniting broadly with the jugal below, and has no connection with the slender squamosal. There is apparently no post-frontal. Lying within the comparatively small orbit are eleven or twelve sclerotic plates, touching each other at their edges, and forming the larger part of a ring, a few having been misplaced. The mandibular symphysis is short, and the two sides are so firmly co-ossified that I have found no trace of the suture. There are about twenty teeth in each jaw, extending far back, the anterior ones very much larger than the posterior ones; in the locked jaws the upper ones reaching nearly to the lower margin of the stout mandible. A part of a single bone was found between the jaws, which I believe to pertain to a hyoid.

I need not point out the importance of the foregoing characters. Others scarcely less interesting will be given later. The ones here given, however, are nearly all in conflict with generic, family, ordinal, or even super-ordinal characters hitherto accepted. The sclerotic plates are the first ones described for any of the *Synaptosauria*, a branch comprising the *Chelonia* and *Sauropterygia*.

The species can be located with neither *Polycotylus* or *Elasmosaurus*, the two genera of the American cretaceous hitherto described as having co-ossified neural arches. I place it, however, under *Cimoliosaurus*, in Lydekker's acceptation, and shall describe and figure it under the name *C. Snowii*, in honor of Chancellor F. H. Snow, who has done so much for the development of the natural-history department of our university. I append a few measurements: length of skull from occipital condyle to top of premaxilla, 18 inches; greatest height of skull to top of parietal

crest, 9 inches; length of centrum of second cervical vertebra, $1\frac{1}{2}$ inches; height of centrum of second cervical vertebra, $1\frac{1}{2}$ inches; height of spine above centrum, same vertebra, $2\frac{1}{2}$ inches; length of centrum of eighteenth cervical vertebra, $2\frac{1}{4}$ inches; height of centrum, same vertebra, 2 inches; length of centrum of twenty-fifth cervical vertebra, $3\frac{1}{2}$ inches.

S. W. WILLISTON.

University of Kansas, Oct. 25.

On the Characters and Systematic Position of the Large Sea-Lizards, *Mosasauridae*.

A NEARLY complete skeleton of one of the mosasauroid reptiles, collected during the summer in the cretaceous of Kansas, enables me to give full characters of this family, and to determine absolutely its relations.

The skull is nearly, in every respect, of the pattern of the *Varanidae*; the premaxillaries co-ossified with nasals, forming a single bone; frontals single, but indications of former division in front; parietals single; post-orbital arch complete,—a bony postorbito-quadrate arch. This arch is formed by the postfronto-orbitals, which are free from each other in young specimens, and by the quadratojugal (squamosal); pterygoids and palatines separated, pterygoids with teeth; vomers separated behind, connected in front; a small ecto-ptyergoid (transverse bone); infra-orbital fossa as in *Varanidae*; nasal opening formed by naso premaxillary, frontal, prefrontal, maxillary; orbits formed by prefrontal, jugal, postfronto-orbital, and a very small portion of the frontal; epipterygoid as in *Varanidae*; no ossified alisphenoid; par-occipital (opisthotic) co-ossified with ex-occipital; petrosal (pro-otic) suturally united or co-ossified with ex-occipital and par-occipital; quadratojugal, squamosal, par-occipital, and quadrate, exactly in the same relations as in *Varanidae*; lower jaw as in *Varanidae*.

I have to mention here the important fact that the *Varanidae* and *Helodermatidae* have, like the *Mosasauridae*, the peculiar articulation in the middle of each ramus, which enables these animals to extend the lower jaws considerably. The shoulder-girdle is between that of *Varanidae* and *Helodermatidae*. There is a very well developed interclavicle, a little divided at the proximal end. The clavicles are small and slender.

From all this it is evident that the *Mosasauridae* are very closely related to the *Varanidae*. They simply represent highly specialized aquatic forms. The enormous size of some of the *Mosasauridae* has to be explained by that fact. I may remark here, however, that some fossil *Varanidae* (*Varanus*) [*Megalonia*] *priscus*, Owen, for instance) from the pleistocene of Queensland reached a length of thirty feet. The *Helodermatidae* belong to the same group, but the *Mosasauridae* are very much nearer to the *Varanidae*. For this group I retain the old name *Platynota*, and divide it into two superfamilies,—(a) *Varanoidea*, 1. *Varanidae*, 2. *Mosasauridae*; (b) *Helodermatoidea*, 1. *Helodermatidae*.

A full account of the *Mosasauridae*, with figures, will soon be published.

G. BAUR.

Clark University, Worcester, Mass., Oct. 29.

Two New Species of Tortoises from the South.

THROUGH the kindness of Mr. Gustave Kohn of New Orleans, La., I have received for examination a splendid collection of *Testudinata* from the Southern States: Louisiana, Florida, Alabama. This collection contains two new species of *Malacoclemmys*.

1. *Malacoclemmys oculifera* (sp. nov.).—This is one of the most beautiful of the American tortoises, and it is certainly very remarkable that it has not been described before. It was labelled *M. Lesueuri*, but it is totally different from that. The shell is broader and higher. The bony tubercles on the vertebral plates are more developed. Each of the dermal scutes of the carapace contains a yellow ring, bordered on the inside and outside with dark olive-brown. These rings are especially well developed on the costal scutes. This condition induced me to propose the name *oculifera*. The plastron is yellow, but with markings very much like *Chrysemys bellii*, Gray. The color of these markings is like the carapace, olive-brown. The head is entirely different from that of any of the described forms of *Malaco-*

clemmys. There is a large yellow spot behind the eyes, two yellow stripes from the orbit backwards, and a very characteristic yellow stripe covering the whole lower jaw. The upper and lower jaws are rounded in front. There are males and females in the collection. The localities where these tortoises were found are Mandeville, La., and Pensacola, Fla. Specimens from Mandeville, La., I consider as the types. Such specimens are also in the collection of the Smithsonian Institution, Washington, D.C., sent by Mr. G. Kohn, No. 15,511, etc.

2. *Malacoclemmys Kohnii* (sp. nov.).—Three specimens labelled *M. geographica* are in Mr. Kohn's collection. They represent another interesting new species. The form of the shell is much like that of *M. oculifera*. The coloration is totally different, and resembles very much that of *M. Lesueuri*. The skull is quite different from that of *M. geographica*. The alveolar surfaces of the upper jaw do not meet in the middle line as in *M. geographica*: they are not so broad, therefore. They resemble more *M. Lesueuri* in that respect, but are broader. The symphysis of the lower jaw is longer than in that species. The coloration of the head is also quite different from *M. Lesueuri*: there is no big yellow spot behind the eye, but a thin yellow line, which is connected with another one running behind from the upper part of the orbit. The localities where found are Bayou Lafourche, La.; Bayou Teche, St. Martinsville, La.; Pensacola, Fla. I take the Louisiana forms as types. I have named this species in honor of Mr. G. Kohn, who collected the specimens.

From this it is seen that we have now five species of *Malacoclemmys* in the United States,—*M. terrapin*, Schoepff; *M. geographica*, Les.; *M. Lesueuri*, Gray; *M. oculifera*, sp. nov.; *M. Kohnii*, sp. nov.

It is probable that *M. terrapin*, the common diamond-back, shows variations according to different localities, and I should be very glad to get specimens from different points on the coast. The new species will be fully described and figured soon.

G. BAUR.

Clark University, Worcester, Mass., Oct. 27.

Remains of the Primitive Elephant found in Grinnell, Io.

HOWEVER common the remains of the mammoth may have become, there is always more or less interest attached to the discovery of each new individual, however fragmentary, or wherever found. According to vague rumors, the first evidence of the mammoth's remains in Grinnell came to light so early in the history of the town, that it has passed into obscurity; and the bones, treasured for a time as private relics, have simply disappeared, no one knows just when or how. It is not certain whether this doubtful specimen was a distinct individual, or part of the one subsequently found near the same place. The last one alluded to was found in 1884, while breaking ground for the Eagle Block, on the north-east corner of Main Street and Fourth Avenue. This animal, a large adult male, is represented by a tusk (eight feet long and nine inches in diameter), several grinders, lower jaw, and part of zygomatic arch, preserved in the museum of Iowa College. These bones occurred about five feet below the surface, and were in an exceedingly soft and perishable condition, as similarly situated remains usually are; but, owing to the skill of Professor H. W. Parker, the tusk and teeth especially were so well fixed with hardening-mixtures, that they were removed in an exceptionally fine condition. The other bones were naturally more fragmentary. The mandible is represented by a large fragment, including the entire symphyseal region, the left ramus being complete as far as the angle. No limb bones in whole or part were taken out with these fragments, although many bones were seen in the clay passing under the walls of an adjoining block, endangering its foundations if dug out, and consequently left there. Doubtless when other excavations are made on the lots immediately adjoining, other bones will be found. Judging by the condition of the parts now at hand, it is not unreasonable to hope that a skeleton nearly complete may yet be unearthed.

Remains of another *Elephas primigenius* have just come to light, found Oct. 6, 1890, within half a mile of the site of the one of 1884. There is additional interest attached to this one, because of the depth at which it occurred. Workmen, while engaged in

excavating an enormous well to supply the water-tanks of the Iowa Central Railroad, came upon certain badly broken mammoth bones, in the drift clay and pebbles, at a depth of twenty feet. All the bones, save a well-worn molar, were badly comminuted, and all the surroundings lead inevitably to the conclusion that they were transported with the drift in which they occurred. In addition to the small though complete molar, there were limb bones, a scapula, ribs, and a small tusk some five or six inches in diameter. The tusk, however, extended into the sides of the well in such a way that it could not be taken out without danger of a cave-in, and was left. The scapula, when found, was fairly complete, but was almost destroyed in the taking-out, little beside the thickened parts in the region of the glenoid fossa remaining. The few limb bones, owing to their fragmentary condition, coupled with the inexperience of the workmen in digging out such remains, were almost totally destroyed; the proximal end of a tibia, a fragment of the shaft of a femur, and the casts in clay of the medullary cavities of the same, being about all that remains to show for them at all. Although it is by no means uncommon to find skeletons of mammoths close to one another, yet it is less so to find them so far below the surface. ERWIN H. BARBOUR.

Iowa College, Grinnell, Io., Oct. 15.

Photo-Mechanical Work.

I WISH to remove, as far as may be, a wrong impression which your readers get from a short news item in your issue of Oct. 24, p. 231. Speaking of the coming exhibition by the Camera Club, of work by the several photo-mechanical processes, you say that "it is a remarkable fact that in no exhibition have they [photo-mechanical results] been brought together for comparison and study."

This statement is very misleading. In the United States National Museum in Washington, in the Section of Graphic Arts, under Mr. S. R. Koehler's management as curator, a large space (I think about nine hundred square feet of wall and cases) is devoted solely to photo-mechanical work and processes. This collection is both historical and technical; and I am perfectly safe in saying that there is no exhibition or collection of the kind anywhere that comes near it in instructiveness, general excellence, and beauty. In completeness the specimens here brought together form a remarkable whole, extending from the earliest times without a break to the present day.

The Camera Club will, I do not doubt, make a beautiful exhibition of recent photo-mechanical work; but the older necessary steps in the evolution of these arts, most difficult to get and most difficult to present effectively for educational and comparative purposes, are not likely to be represented in New York as they are in the National Museum here.

J. W. OSBORNE.

Washington, D.C., Oct. 30.

MY attention has been called to a note in your issue of Oct. 24, announcing an exhibition of photo-mechanical process-work to be held by the New York Camera Club. In this note it is stated to be "a remarkable fact that in no exhibition have they [i.e., the photo-mechanical processes] been brought together for comparison and study." By referring to the "Classification of Exhibits in the Section of Graphic Arts," of the Smithsonian Institution, United States National Museum, you will see that considerable space is devoted to the illustration of the processes in question at the institution named. We endeavor not only to illustrate the various processes in their technical aspects and in their results as they are seen to-day, but it is our aim also to bring together an historical series; and I am happy to say that our efforts in this direction have not been quite unsuccessful. Among the specimens illustrating the development of the photo-mechanical processes historically is one by Nicephore Niepce (1824), while Fox, Talbot, Poitevin, Paul Pretsch, Tessié du Motay, Asser, Toovey, Osborne, Sir Henry James, Davanne, Lemerrier, Pouncy, Bradford (of Boston), and others, are represented by several specimens each. That the workers of to-day, especially those of America, are well represented, goes without saying.

For these results the United States National Museum is largely

indebted to Mr. J. W. Osborne of Washington, Professor Chandler of Columbia College, New York, Mr. Ives of Philadelphia, and to nearly all the leading houses engaged in photo-mechanical work in New York, Philadelphia, and Boston. Permit me to add that further assistance, from whatever quarter it may come, will be gladly accepted and duly acknowledged.

The "Catalogue of the Contributions of the Section of Graphic Arts to the Ohio Valley Centennial Exposition, Cincinnati, 1888," shows that the modern photo-mechanical processes were very fully illustrated in the exhibition.

S. R. KOEHLER.

Washington, D.C., Oct, 31.

BOOK-REVIEWS.

An Easy Method for Beginners in Latin. By ALBERT HARKNESS. New York, American Book Company. 12°.

THIS new volume by Professor Harkness approaches the Latin language on what may be called its practical side, being intended, not as a mere companion to the grammar, but as a useful guide in the work of reading, writing, and speaking the language. It is at once a book of exercises and a reader, containing enough grammar to suffice for the beginner. From the outset practical use is made of the language as such, the complete sentence—verb, subject, and object—being introduced in the very first chapter.

The exercises throughout the book are mainly conversational; and great care has evidently been taken to select interesting and instructive subjects, to present them attractively, and to enliven them by the frequent introduction of anecdotes, stories, dialogues, etc. Questions in Latin on the subjects treated are introduced regularly, not to be translated, but to be answered in Latin, treating the language to some extent as a living instead of a dead one. This must greatly lighten the task of the learner, though it need not necessarily endanger the thoroughness of his work.

The method of treatment adopted by Professor Harkness in this

work is largely inductive. Grammatical principles are presented to the learner embodied and illustrated in the language itself, before he is called upon to use them in constructive work. It must not be understood from this that the grammar has been neglected. It is simply approached from a different point, introduced as needed in the exercises, and applied in a way that lightens the task of learning it, and fastens it in the memory by immediate and constant use. The book is illustrated by four full-page colored plates and a number of engravings of classical subjects treated of in the text and reproduced from authentic sources. On the whole, the new volume is a valuable addition to the series of Latin text-books by the same author, so well-known to our educators.

AMONG THE PUBLISHERS.

IN the November *Magazine of American History*, Rev. Charles H. Parkhurst contributes the opening chapter, "Divine Drift in Human History." The second article, "American Outgrowths of Continental Europe," by the editor, is based upon the "Narrative and Critical History of America." It is followed by Gen. Winfield Scott's "Remedy for Intemperance," from Hon. Charles Aldrich; "The Puritan Birthright," by Nathan M. Hawkes; and "The Action at Tarrytown, 1781," by Dr. R. B. Coutant. One of the longest papers in the number is that of Dr. Prosper Bender, the third in his series of "The French-Canadian Peasantry." The "Library of a Philadelphia Antiquarian," by E. Powell Buckley, will be perused with interest by all scholars. "Revolutionary Newburgh" is an historic poem by Rev. Edward J. Runk. A glimpse of the "Literature of California" is from the writings of Hubert Howe Bancroft.

—The *Illustrated American* gives a new point to a well-worn problem. It says, "When a wheel is in motion, does the top move faster than the bottom? Nine people out of ten would cry

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—Messrs. Kegan Paul, Trench, Trübner, & Co.'s October announcements include among many others the following of special interest to our readers: "Essays, Scientific and Philosophical," by the late Rev. Aubrey Lackington Moore; "The Philosophy of Right," by Professor Diodato Liroy, translated from the Italian by W. Hastie, B.D.; "Confucius, the Great Teacher: a Study," by Major-Gen. G. G. Alexander, C.B.; "The Life of Philip Henry Gosse, F.R.S.," by his son, Edmund Gosse; "Disraeli and his Day," by Sir William Fraser; "Turanian Stock: being a New Division of 'Social History of the Races of Mankind,'" by A. Featherman; "Free Exchange: Papers on Political and Economi-

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to be the editor-in-chief. The first number will appear Jan. 1, 1891, and will contain "Great Glaciers of the Selkirks," by C. M. Skinner; "Progress of the Nicaragua Canal," by R. E. Peary, C.E., U.S.N.; "Americans in Tropical Africa," by Heli Chatelain; "Our Remaining Territories," by Cyrus C. Adams; "Methods of teaching Geography in Germany," by J. S. Keltie; "Arctic Exploration in 1891," by Cyrus C. Adams; "Railroad Pioneers in New Lands," by S. T. Jennings; "Hunting for Fossils on the Kongo," by G. E. Dupont; "Eskimo Maps," by Capt. G. Holm; "Victims of the Sultan of Morocco," by Albert Kirchoff; "How to popularize Geography," by George C. Hurlburt; "Our Geographical Progress," "Work of the Geological Survey," "The Exploration of Alaska," "Young Folks' Geographical Corner," "The Little Boys Stanley bought," "First White Child in the Arctic Regions," "Women Mountain-Climbers in 1890," "Other Day, the Sioux Hero," "Talk about Explorers, Discovery, and Books," "Stanley's Criticisms on Map-Makers," "Magazines devoted solely to

Africa," Reclus's *Géographie Universelle* and his *Literary Methods*," "Denmark's Great Volumes on Greenland," "Some Features of German Maps," "The Geographical Exhibition of the Brooklyn Institute," "New Boundary Lines in Africa," "Buettner's Travels in Liberia," "Tourist Routes in New Lands," "Traces of the Lost Explorer, Leichhardt," "New Islands in the Seas," "Record of Geographical Progress."

—*Babyhood* for November contains an article on "Vegetables as Food for Young Children," by the medical editor, Dr. L. M. Yale. Of no less interest to young mothers is the article on the "Care of the Baby's Skin," by Dr. G. T. Jackson, the chief of the skin clinic at the New York College of Physicians and Surgeons. "Twice-Told Nursery Tales" is another medical article. The departments of "Occupations and Amusements," and the replies of the medical editor to the many questions asked by perplexed mothers, will be found very helpful.

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Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, or the services of any scientific man, or who in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

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CALENDAR OF SOCIETIES.

Boston Society of Natural History.

Nov. 5. — G. H. Barton, Drumlins of Massachusetts; F. W. Putnam, Archaeological Explorations in Ohio during the Past Season.

New York Academy of Sciences.

Nov. 3. — J. S. Newberry, On the Geological Age and Relations of the Potomac Group, of Virginia and Maryland (illustrated by specimens); Alexis A. Julien, On the Microbe of Phosphorescent Wood (illustrated by microscopic preparations).

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